PATENT ABSTRACTS OF JAPAN

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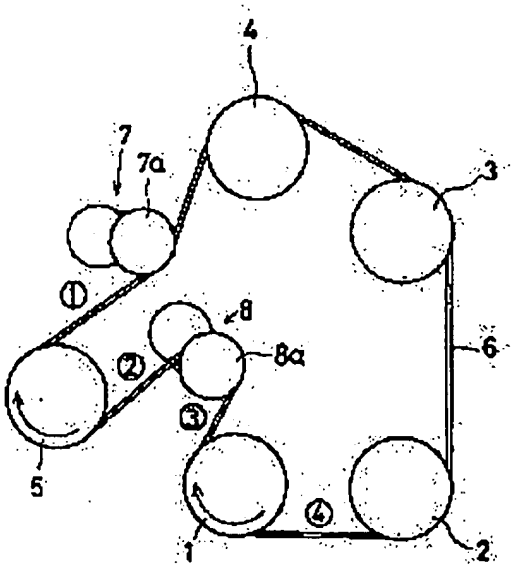
(54) BELT TRANSMISSION SYSTEM FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a belt transmission system which can prevent slipping of a belt without increasing the initial tension thereof when an accessory is driven by an engine, and which can prevent the belt from slacking due to aging effect or variation in environment.

SOLUTION: This belt transmission device comprises a first automatic tensioner 7 and a second automatic tensioner 8 which can adjust the tension of a belt. The first automatic tensioner 7 has an idler pulley 7a located on the slacking side of the belt 6 with respect to a pulley 5 of an accessory module, and the second automatic tensioner 8 has an idle pulley 8a located between the pulley 5 of the accessory module and a crank pulley 1. It is noted that the idler pulley 8a of the second automatic tensioner 8 is set to be stationary in order to prevent lowering of the degree of belt tension which is required for transmitting a starting torque of the accessory module during a start of an engine, to the crank pulley 1.



LEGAL STATUS

[Claim(s)]

[Claim 1] It is spanned with a belt between the pulleys provided, respectively in other auxiliary machinery other than an internal combustion engine, the motor for starting, and this motor for starting. Transmit the turning effort produced in the aforementioned motor for starting through this belt to the aforementioned internal combustion engine, and an internal combustion engine is put into operation. The turning effort produced in the internal combustion engine can be transmitted to auxiliary machinery besides the above, and other auxiliary machinery can be driven. It is the belt duction system which has arranged the 1st auto tensioner which can adjust belt tension to the slack side of the aforementioned belt to the aforementioned motor for starting. The 2nd auto tensioner which can adjust belt tension between the aforementioned internal combustion engine and the aforementioned motor for starting is arranged. this 2nd auto tensioner When the idle pulley arranged between the crank pulley of the aforementioned internal combustion engine and the pulley of the aforementioned motor for starting is provided and the aforementioned internal combustion engine is put into operation with the aforementioned motor for starting It is the belt duction system for internal combustion engines characterized by the aforementioned idle pulley being in flight readiness when the position of the aforementioned idle pulley is fixed and auxiliary machinery besides the above is driven with the aforementioned internal combustion engine.

[Claim 2] It is spanned with a belt between an internal combustion engine, the auxiliary machinery module having a starting function and other functions, and the pulley provided in other auxiliary machinery other than this auxiliary machinery module, respectively. Transmit the turning effort produced to the aforementioned auxiliary machinery module through this belt to the aforementioned internal combustion engine, and an internal combustion engine is put into operation. The turning effort produced in the internal combustion engine can be transmitted to auxiliary machinery besides the above, and other auxiliary machinery can be driven. It is the belt duction system which has arranged the 1st auto tensioner which can adjust belt tension to the slack side of the aforementioned belt to the aforementioned auxiliary machinery module. The 2nd auto tensioner which can adjust belt tension between the aforementioned internal combustion engine and the aforementioned auxiliary machinery module is arranged. this 2nd auto tensioner When the idle pulley arranged between the crank pulley of the aforementioned internal combustion engine and the pulley of the aforementioned auxiliary machinery module is provided and the aforementioned internal combustion engine is put into operation with the aforementioned auxiliary machinery module It is the belt duction system for internal combustion engines characterized by the aforementioned idle pulley being in flight readiness when the position of the aforementioned idle pulley is fixed and auxiliary machinery besides the above is driven with the aforementioned internal combustion engine.

[Claim 3] It is spanned with a belt between the pulleys provided, respectively in other auxiliary machinery other than an internal combustion engine, the motor for starting, and this motor for starting. Transmit the turning effort produced in the aforementioned motor for starting through this belt to the aforementioned internal combustion engine, and an internal combustion engine is put into operation. In the belt duction system possessing the auto tensioner which transmits the turning effort produced in the internal combustion engine to auxiliary machinery besides the above, can drive other auxiliary machinery and

gives predetermined tension to the aforementioned belt The belt duction system for internal combustion engines characterized by forming the tensioner controlling mechanism which detects the aforementioned rate of a belt slippage and carries out adjustable [of the belt tension by the aforementioned auto tensioner] according to the slip factor.
[Claim 4] It is spanned with a belt between an internal combustion engine, the auxiliary machinery module having a starting function and other functions, and the pulley provided in other auxiliary machinery other than this auxiliary machinery module, respectively. Transmit the turning effort produced to the aforementioned auxiliary machinery module through this belt to the aforementioned internal combustion engine, and an internal combustion engine is put into operation. In the belt duction system possessing the auto tensioner which transmits the turning effort produced in the internal combustion engine to auxiliary machinery besides the above, can drive other auxiliary machinery and gives predetermined tension to the aforementioned belt The belt duction system for internal combustion engines characterized by forming the tensioner controlling mechanism which detects the aforementioned rate of a belt slippage and carries out adjustable [of the belt tension by the aforementioned auto tensioner] according to the slip factor.
[Claim 5] The tensioner controlling mechanism indicated to the claim 3 is a belt duction system for internal combustion engines characterized by being applied to the 1st auto tensioner or the 2nd auto tensioner indicated to the claim 1.
[Claim 6] The tensioner controlling mechanism indicated to the claim 4 is a belt duction system for internal combustion engines characterized by being applied to the 1st auto tensioner or the 2nd auto tensioner indicated to the claim 2.
[Claim 7] The auto tensioner of the above 1st or the 2nd auto tensioner is the belt duction system for internal combustion engines indicated to the claims 1 and 2 characterized by providing the elastic body which an elastic modulus increases and carrying out adjustable [of the belt tension] according to the elastic modulus of this elastic body so that temperature falls.

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the belt transmission system for internal combustion engines which transmits the turning effort at the time of starting of an internal combustion engine, and the auxiliary machinery drive by the internal combustion engine with a belt.
[0002]
[Description of the Prior Art] Conventionally, in a well-known belt duction system, since big transmission torque is needed when starting an engine with an auxiliary machinery module (or motor for starting), it is necessary to apply high initial tension to a belt, and the problem are not desirable is produced on the durability of a belt. Then, these people proposed the belt duction system which has arranged the auto tensioner 120 to the slack side of a belt 110 to the pulley 100 of an auxiliary machinery module, as shown in drawing 7 (refer to Japanese Patent Application No. 359071 [nine to]).
[0003]
[Problem(s) to be Solved by the Invention] However, in the belt duction system of point **, since the generation source of turning effort changes to an engine from an auxiliary

machinery module in the time of engine starting and an auxiliary machinery drive, in connection with it, the tension side of the belt 110 to a turning-effort generation source and the position by the side of slack move. Consequently, as shown in drawing 8 , belt tension may decline most between the crank pulleys 130 and the pulleys 100 of an auxiliary machinery module which were attached in the crankshaft, and belt slipping may occur with the pulley 100 of the crank pulley 130 or an auxiliary machinery module. In addition, the round-head number shown in drawing 8 is equivalent to the round-head number between each pulley shown in drawing 7 .

[0004] It is difficult to increase setting tension until it can prevent belt slipping since the endurance of a belt 110 falls remarkably in that case, although it can consider enlarging setting tension of the above-mentioned auto tensioner 120 as a cure of the above-mentioned belt slipping. Moreover, it is difficult to also set up the initial tension of the auto tensioner 120 greatly beforehand in consideration of the slack of the belt 110 by the aging etc. from the above-mentioned ground. this invention is to offer the belt duction system which it was able to accomplish based on the above-mentioned situation, and the purpose can prevent belt slipping in a pulley, without increasing the initial tension of a belt at the time of the auxiliary machinery drive by the internal combustion engine, and can prevent the slack of the belt by the aging, the environmental variation, etc.

[0005]

[Means for Solving the Problem] (Means of a claim 1) The 2nd auto tensioner which can adjust belt tension between an internal combustion engine and the motor for starting is arranged, when this 2nd auto tensioner possesses the idle pulley arranged between the crank pulley of an internal combustion engine, and the pulley of the motor for starting and an internal combustion engine is put into operation with the motor for starting, the position of an idle pulley is fixed, and when driving other auxiliary machinery with an internal combustion engine, an idle pulley will be in flight readiness. According to this configuration, the initial tension of the belt by the 1st auto tensioner is maintainable by the position of the idle pulley of the 2nd auto tensioner being fixed at the time of starting of an internal combustion engine. Moreover, at the time of an auxiliary machinery drive, the function as auto tensioner can be obtained by the idle pulley of the 2nd auto tensioner being in flight readiness. That is, the slack of a belt can be prevented between the crank pulley of an internal combustion engine, and the pulley of the motor for starting, and belt tension can be maintained at abbreviation regularity.

[0006] (Means of a claim 2) The 2nd auto tensioner which can adjust belt tension between an internal combustion engine and an auxiliary machinery module is arranged, when this 2nd auto tensioner possesses the idle pulley arranged between the crank pulley of an internal combustion engine, and the pulley of an auxiliary machinery module and an internal combustion engine is put into operation with an auxiliary machinery module, the position of an idle pulley is fixed, and when driving other auxiliary machinery with an internal combustion engine, an idle pulley will be in flight readiness. According to this configuration, the initial tension of the belt by the 1st auto tensioner is maintainable by the position of the idle pulley of the 2nd auto tensioner being fixed at the time of starting of an internal combustion engine. Moreover, at the time of an auxiliary machinery drive, the function as auto tensioner can be obtained by the idle pulley of the 2nd auto tensioner being in flight readiness. That is, the slack of a belt can be prevented between the crank pulley of an internal combustion engine, and the pulley of an auxiliary machinery

module, and belt tension can be maintained at abbreviation regularity.
[0007] (Means of claims 3 and 4) The rate of a belt slippage is detected and it is characterized by forming the tensioner controlling mechanism which carries out adjustable [of the belt tension by auto tensioner] according to the slip factor. If it is at the starting time of an internal combustion engine and it is at the pulley [of the motor for starting], or auxiliary machinery drive time when slack arises to a belt and belt tension declines by the aging, the environmental variation, etc., belt slipping will be produced by the crank pulley. Then, this rate of a belt slippage is detected and belt slipping in a pulley can be prevented by adjusting the belt tension by auto tensioner according to the slip factor. In addition, enlarging torque of auto tensioner so that a slip factor is large and belt tension may increase in this case cannot be overemphasized.
[0008] (Means of a claim 5) The tensioner controlling mechanism indicated to the claim 3 can prevent belt slipping in each pulley at the time of starting of the internal combustion engine by the motor for starting, and the auxiliary machinery drive by the internal combustion engine by applying to the 1st auto tensioner or the 2nd auto tensioner indicated to the claim 1.
[0009] (Means of a claim 6) The tensioner controlling mechanism indicated to the claim 4 can prevent belt slipping in each pulley at the time of starting of the internal combustion engine by the auxiliary machinery module, and the auxiliary machinery drive by the internal combustion engine by applying to the 1st auto tensioner or the 2nd auto tensioner indicated to the claim 2.
[0010] (Means of a claim 7) The 1st auto tensioner or the 2nd auto tensioner possesses the elastic body which an elastic modulus increases, and is characterized by carrying out adjustable [of the belt tension] according to the elastic modulus of this elastic body so that temperature falls. In a common belt duction system, there is an inclination to become easy to slide on a belt so that an outside air temperature becomes low. Then, since belt tension can be increased at the time of low temperature by using the elastic body (for example, rubber material) which an elastic modulus increases so that temperature falls to auto tensioner, belt slipping can be prevented.
[0011]
[Embodiments of the Invention] Next, the belt transmission system for internal combustion engines of this invention is explained based on a drawing.
(The 1st example) View 1 is the layout pattern of a belt transmission system. Two or more pulleys 1-5 are spanned with one belt 6, and the belt transmission system of this example has the 1st auto tensioner 7 and the 2nd auto tensioner 8 which can adjust the belt tension, as the power transmission by belt duction is performed between an engine, an auxiliary machinery module, and other auxiliary machinery other than this auxiliary machinery module and it is shown in drawing 1 . In addition, an auxiliary machinery module is the auxiliary machinery having the starter ability which puts an engine into operation, and other functions (for example, power generation function).
[0012] Two or more pulleys 1-5 are the crank pulley 1 attached in the crankshaft of an engine, the pulleys 2, 3, and 4 attached in the rotation axis of each auxiliary machinery, respectively, and the pulley 5 attached in the rotation axis of an auxiliary machinery module, and are arranged with the layout shown in drawing 1 . In addition, an auxiliary machinery module shall be rotated in the orientation of the arrow head which shows a pulley 5 in drawing 1 on the turning effort generated at the time of engine starting, and an

engine shall be rotated in the orientation of the arrow head which shows a crank pulley 1 in drawing 1 on the turning effort which self generates.
[0013] Idle-pulley 7a is arranged to the pulley 5 of an auxiliary machinery module at the slack side of a belt 6, and the 1st auto tensioner 7 has given belt tension required at the time of engine starting by the auxiliary machinery module. Idle-pulley 8a is arranged between the pulley 5 of an auxiliary machinery module, and the crank pulley 1, and the 2nd auto tensioner 8 has given belt tension required at the time of the auxiliary machinery drive by the engine. However, at the time of engine starting, the position of idle-pulley 8a is fixed so that belt tension required in order that the 2nd auto tensioner 8 may transmit the starting torque of an auxiliary machinery module to a crank pulley 1 at the time of engine starting may not decline (it **s the bottom).
[0014] This 2nd auto tensioner 8 has 8d of the moving part attached possible [rotation] through elastic body 8c (for example, rubber) to base section 8b fixed to the body of a vehicle etc., and this base section 8b as shown in drawing 2 (a), and idle-pulley 8a is attached at the nose of cam of arm 8e established in this 8d of moving part and one free [rotation]. 8d of moving part possesses stopper 8f which regulates the deflection angle of arm 8e to base section 8b, and the position of idle-pulley 8a is regulated by this stopper 8f hitting base section 8b. Therefore, as shown in drawing 2 (b), even if the torque (belt tension concerning idle-pulley 8a) which the elasticity of elastic body 8c is resisted [torque] and rotates 8d of moving part increases, the deflection angle of arm 8e is regulated by stopper 8f hitting base section 8b.
[0015] Next, an operation of this example is explained.
a) A pulley 5 rotates in response to the turning effort generated to an auxiliary machinery module at the time of engine starting (it is a RRC in drawing 1), the turning effort is transmitted to a crank pulley 1 by belt duction, a crank pulley 1 rotates, and an engine starts. At the time of this engine starting, since the starting torque of an auxiliary machinery module is transmitted to the crank pulley 1 of an engine, as shown in drawing 3 , big belt tension is applied to idle-pulley 8a of the 2nd auto tensioner 8. Thereby, in the 2nd auto tensioner 8, the deflection angle of arm 8e becomes large, and idle-pulley 8a is fixed for stopper of 8d of moving part 8f in contact with base section 8b. In addition, the round-head number shown in drawing 3 is equivalent to the round-head number between each pulley shown in drawing 1 .
[0016] b) If an engine starts with an auxiliary machinery module at the time of an auxiliary machinery drive, the turning effort of an engine will be transmitted to the pulleys 2-4 of each auxiliary machinery by belt duction, and each auxiliary machinery will drive. At the time of this auxiliary machinery drive, since between a crank pulley 1 and the pulleys 5 of an auxiliary machinery module becomes the maximum slack side of a belt 6, the belt tension applied to idle-pulley 8a of the 2nd auto tensioner 8 declines. Thereby, the deflection angle of arm 8e becomes small, and the 2nd auto tensioner 8 moves in the orientation to which idle-pulley 8a which was being fixed at the time of engine starting makes belt tension increase. Consequently, as shown in drawing 3 , it does not fall more greatly than the initial tension to which the belt tension by the side of the maximum slack is set by the 1st auto tensioner 7, and belt tension required at the time of the auxiliary machinery drive by the engine is maintained.
[0017] (Effect of the 1st example) In the above-mentioned belt duction system Since the 2nd auto tensioner 8 is arranged between an engine and an auxiliary machinery module

and idle-pulley 8a of the 2nd auto tensioner 8 is fixed in a predetermined position (position where stopper 8f contacts base section 8b) at the time of engine starting, Belt tension required in order for belt tension not to decline by the maximum tension side (between the pulley 5 of an auxiliary machinery module and the crank pulleys 1) of the belt 6 at the time of engine starting and to transmit starting torque is maintainable.
[0018] Moreover, at the time of an auxiliary machinery drive, idle-pulley 8a of the 2nd auto tensioner 8 can be in flight readiness, belt tension can be held to abbreviation regularity (equivalent to the initial tension set up by the 1st auto tensioner 7) by idle-pulley 8a moving to the slack of a belt 6, and belt tension required in order to transmit the driving torque at the time of the auxiliary machinery drive by the engine can be maintained. Thereby, belt slipping in the pulley 5 of the crank pulley 1 or an auxiliary machinery module can be prevented, and the slack of the belt 6 by the aging, the environmental variation, etc. can be absorbed by the 2nd auto tensioner 8. Consequently, since it is not necessary to set up the initial tension of the 1st auto tensioner 7 beyond the need greatly, the endurance of a belt 6 is maintainable good.
[0019] In addition, in a common belt duction system, there is an inclination to become easy to slide on a belt 6 so that an outside air temperature becomes low. Then, since elastic body 8c used for the 2nd auto tensioner 8 can increase belt tension at the time of low temperature by using the quality of the material (for example, rubber) which an elastic modulus increases so that temperature falls, it can acquire the effect that belt slipping can be prevented. Moreover, although this 1st example showed the system which puts an engine into operation with an auxiliary machinery module, even when using the motor (starter) for starting instead of an auxiliary machinery module, the same effect as the 1st example can be acquired.
[0020] (The 2nd example) View 4 is the block diagram of a tensioner controlling mechanism. The belt duction system of this example detects the slip factor of a belt 6, and has the tensioner controlling mechanism which controls the belt tension by the 1st auto tensioner 7. As shown in drawing 4 , this tensioner controlling mechanism computes the slip factor of a belt 6 from the detection value of the 1st tachometer 9 which detects the rotational speed by the side of an engine (for example, the crank pulley 1 or a crankshaft), the 2nd tachometer 10 which detects the rotational speed by the side of an auxiliary machinery module (for example, the pulley 5 or a rotation axis), and both the tachometers 9 and 10, and is equipped with the drive circuit 11 which controls the 1st auto tensioner 7 according to the slip factor.
[0021] In addition, as the 1st auto tensioner 7 is shown in drawing 5 , base section 7b is connected with actuator 7A, and idle-pulley 7a is being fixed at the nose of cam of arm 7e at which 7d of the base section 7b and moving part were connected through elastic body 7c, and they were further prepared in 7d of moving part, and one. This 1st auto tensioner 7 can change the movable domain of arm 7e (deflection angle) by changing angle of rotation of base section 7b by actuator 7A.
[0022] an increase of the above-mentioned tensioner controlling mechanism of the slip factor of a belt 6 increases the torque of the 1st auto tensioner 7 -- actuator 7A is controlled like (the elasticity of elastic body 7c increases) Thereby, since the belt tension by the 1st auto tensioner 7 increases, belt slipping can be prevented with the pulley 5 of an auxiliary machinery module.
[0023] In addition, in the above-mentioned explanation, although the slip factor of a belt

6 is computed from the rotational speed by the side of an engine, and the rotational speed by the side of an auxiliary machinery module, as shown, for example in drawing 6 , with the belt speedometer 12, the speed of the belt 6 concerning the pulley 5 of an auxiliary machinery module is detected, the belt speed and the rotational speed by the side of an auxiliary machinery module are measured, and the slip factor of a belt 6 may be computed. Moreover, the belt slip factor in a crank pulley 1 may be computed, and the belt tension of the 2nd auto tensioner 8 may be controlled by the same technique as the 2nd example.

[0024] Although the 1st and 2nd above-mentioned example explains the case where each pulleys 1-5 carry out a RRC on a drawing, this invention can be applied when carrying out a RLC. Moreover, also about an engine, an auxiliary machinery module (or motor for starting), and the layout of each auxiliary machinery, it is not restricted to what was explained in the 1st and 2nd example, and when arranging [for example,] an auxiliary machinery module (or motor for starting) between auxiliary machinery, this invention can be applied.

[The technical field to which invention belongs]

this invention relates to the belt transmission system for internal combustion engines which transmits the turning effort at the time of starting of an internal combustion engine, and the auxiliary machinery drive by the internal combustion engine with a belt.

[Description of the Prior Art]

Conventionally, in a well-known belt duction system, since big transmission torque is needed when starting an engine with an auxiliary machinery module (or motor for starting), it is necessary to apply high initial tension to a belt, and the problem are not desirable is produced on the durability of a belt. Then, these people proposed the belt duction system which has arranged the auto tensioner 120 to the slack side of a belt 110 to the pulley 100 of an auxiliary machinery module, as shown in drawing 7 (refer to Japanese Patent Application No. 359071 [nine to]).

(Effect of the 1st example)

In the above-mentioned belt duction system Since the 2nd auto tensioner 8 is arranged between an engine and an auxiliary machinery module and idle-pulley 8a of the 2nd auto tensioner 8 is fixed in a predetermined position (position where stopper 8f contacts base section 8b) at the time of engine starting, Belt tension required in order for belt tension not to decline by the maximum tension side (between the pulley 5 of an auxiliary machinery module and the crank pulleys 1) of the belt 6 at the time of engine starting and to transmit starting torque is maintainable.

[0018] Moreover, at the time of an auxiliary machinery drive, idle-pulley 8a of the 2nd auto tensioner 8 can be in flight readiness, belt tension can be held to abbreviation regularity (equivalent to the initial tension set up by the 1st auto tensioner 7) by idle-pulley 8a moving to the slack of a belt 6, and belt tension required in order to transmit the driving torque at the time of the auxiliary machinery drive by the engine can be maintained. Thereby, belt slipping in the pulley 5 of the crank pulley 1 or an auxiliary machinery module can be prevented, and the slack of the belt 6 by the aging, the environmental variation, etc. can be absorbed by the 2nd auto tensioner 8. Consequently,

since it is not necessary to set up the initial tension of the 1st auto tensioner 7 beyond the need greatly, the endurance of a belt 6 is maintainable good.
[0019] In addition, in a common belt duction system, there is an inclination to become easy to slide on a belt 6 so that an outside air temperature becomes low. Then, since elastic body 8c used for the 2nd auto tensioner 8 can increase belt tension at the time of low temperature by using the quality of the material (for example, rubber) which an elastic modulus increases so that temperature falls, it can acquire the effect that belt slipping can be prevented. Moreover, although this 1st example showed the system which puts an engine into operation with an auxiliary machinery module, even when using the motor (starter) for starting instead of an auxiliary machinery module, the same effect as the 1st example can be acquired.

[Problem(s) to be Solved by the Invention]
However, in the belt duction system of point **, since the generation source of turning effort changes to an engine from an auxiliary machinery module in the time of engine starting and an auxiliary machinery drive, in connection with it, the tension side of the belt 110 to a turning-effort generation source and the position by the side of slack move. Consequently, as shown in drawing 8 , belt tension may decline most between the crank pulleys 130 and the pulleys 100 of an auxiliary machinery module which were attached in the crankshaft, and belt slipping may occur with the pulley 100 of the crank pulley 130 or an auxiliary machinery module. In addition, the round-head number shown in drawing 8 is equivalent to the round-head number between each pulley shown in drawing 7 .
[0004] It is difficult to increase setting tension until it can prevent belt slipping since the endurance of a belt 110 falls remarkably in that case, although it can consider enlarging setting tension of the above-mentioned auto tensioner 120 as a cure of the above-mentioned belt slipping. Moreover, it is difficult to also set up the initial tension of the auto tensioner 120 greatly beforehand in consideration of the slack of the belt 110 by the aging etc. from the above-mentioned ground. this invention is to offer the belt duction system which it was able to accomplish based on the above-mentioned situation, and the purpose can prevent belt slipping in a pulley, without increasing the initial tension of a belt at the time of the auxiliary machinery drive by the internal combustion engine, and can prevent the slack of the belt by the aging, the environmental variation, etc.

(The 1st example)
View 1 is the layout pattern of a belt transmission system. Two or more pulleys 1-5 are spanned with one belt 6, and the belt transmission system of this example has the 1st auto tensioner 7 and the 2nd auto tensioner 8 which can adjust the belt tension, as the power transmission by belt duction is performed between an engine, an auxiliary machinery module, and other auxiliary machinery other than this auxiliary machinery module and it is shown in drawing 1 . In addition, an auxiliary machinery module is the auxiliary machinery having the starter ability which puts an engine into operation, and other functions (for example, power generation function).
[0012] Two or more pulleys 1-5 are the crank pulley 1 attached in the crankshaft of an engine, the pulleys 2, 3, and 4 attached in the rotation axis of each auxiliary machinery, respectively, and the pulley 5 attached in the rotation axis of an auxiliary machinery module, and are arranged with the layout shown in drawing 1 . In addition, an auxiliary

machinery module shall be rotated in the orientation of the arrow head which shows a pulley 5 in drawing 1 on the turning effort generated at the time of engine starting, and an engine shall be rotated in the orientation of the arrow head which shows a crank pulley 1 in drawing 1 on the turning effort which self generates.

[0013] Idle-pulley 7a is arranged to the pulley 5 of an auxiliary machinery module at the slack side of a belt 6, and the 1st auto tensioner 7 has given belt tension required at the time of engine starting by the auxiliary machinery module. Idle-pulley 8a is arranged between the pulley 5 of an auxiliary machinery module, and the crank pulley 1, and the 2nd auto tensioner 8 has given belt tension required at the time of the auxiliary machinery drive by the engine. However, at the time of engine starting, the position of idle-pulley 8a is fixed so that belt tension required in order that the 2nd auto tensioner 8 may transmit the starting torque of an auxiliary machinery module to a crank pulley 1 at the time of engine starting may not decline (it **s the bottom).

[0014] This 2nd auto tensioner 8 has 8d of the moving part attached possible [rotation] through elastic body 8c (for example, rubber) to base section 8b fixed to the body of a vehicle etc., and this base section 8b as shown in drawing 2 (a), and idle-pulley 8a is attached at the nose of cam of arm 8e established in this 8d of moving part and one free [rotation]. 8d of moving part possesses stopper 8f which regulates the deflection angle of arm 8e to base section 8b, and the position of idle-pulley 8a is regulated by this stopper 8f hitting base section 8b. Therefore, as shown in drawing 2 (b), even if the torque (belt tension concerning idle-pulley 8a) which the elasticity of elastic body 8c is resisted [torque] and rotates 8d of moving part increases, the deflection angle of arm 8e is regulated by stopper 8f hitting base section 8b.

[0015] Next, an operation of this example is explained.

a) A pulley 5 rotates in response to the turning effort generated to an auxiliary machinery module at the time of engine starting (it is a RRC in drawing 1), the turning effort is transmitted to a crank pulley 1 by belt duction, a crank pulley 1 rotates, and an engine starts. At the time of this engine starting, since the starting torque of an auxiliary machinery module is transmitted to the crank pulley 1 of an engine, as shown in drawing 3 , big belt tension is applied to idle-pulley 8a of the 2nd auto tensioner 8. Thereby, in the 2nd auto tensioner 8, the deflection angle of arm 8e becomes large, and idle-pulley 8a is fixed for stopper of 8d of moving part 8f in contact with base section 8b. In addition, the round-head number shown in drawing 3 is equivalent to the round-head number between each pulley shown in drawing 1 .

[0016] b) If an engine starts with an auxiliary machinery module at the time of an auxiliary machinery drive, the turning effort of an engine will be transmitted to the pulleys 2-4 of each auxiliary machinery by belt duction, and each auxiliary machinery will drive. At the time of this auxiliary machinery drive, since between a crank pulley 1 and the pulleys 5 of an auxiliary machinery module becomes the maximum slack side of a belt 6, the belt tension applied to idle-pulley 8a of the 2nd auto tensioner 8 declines. Thereby, the deflection angle of arm 8e becomes small, and the 2nd auto tensioner 8 moves in the orientation to which idle-pulley 8a which was being fixed at the time of engine starting makes belt tension increase. Consequently, as shown in drawing 3 , it does not fall more greatly than the initial tension to which the belt tension by the side of the maximum slack is set by the 1st auto tensioner 7, and belt tension required at the time of the auxiliary machinery drive by the engine is maintained.

[Brief Description of the Drawings]

[Drawing 1] It is the layout pattern of a belt transmission system.

[Drawing 2] It is the graph (b) which sways with the perspective diagram (a) of the 2nd auto tensioner, and torque, and shows the relation of an angle.

[Drawing 3] It is the graph which shows the size of the belt tension between each pulley.

[Drawing 4] It is the block diagram of a tensioner controlling mechanism.

[Drawing 5] It is the perspective diagram of the 1st auto tensioner.

[Drawing 6] It is the block diagram of a tensioner controlling mechanism.

[Drawing 7] It is the layout pattern of the belt transmission system of point **.

[Drawing 8] It is the graph which shows the size of the belt tension between each pulley of point **.

[Description of Notations]

1 Crank Pulley

5 Pulley of Auxiliary Machinery Module

6 Belt

7 1st Auto Tensioner

8 2nd Auto Tensioner

8a The idle pulley of the 2nd auto tensioner

8c Elastic body

9 1st Tachometer (Tensioner Controlling Mechanism)

10 2nd Tachometer (Tensioner Controlling Mechanism)

11 Drive Circuit (Tensioner Controlling Mechanism)

12 Belt Speedometer (Tensioner Controlling Mechanism)

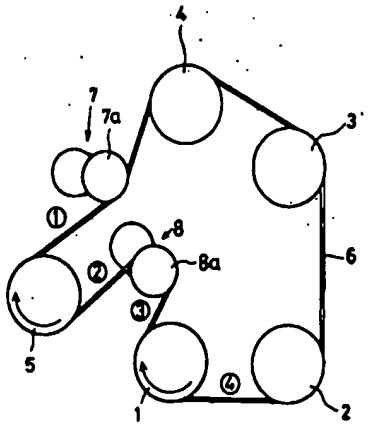


Figure 1

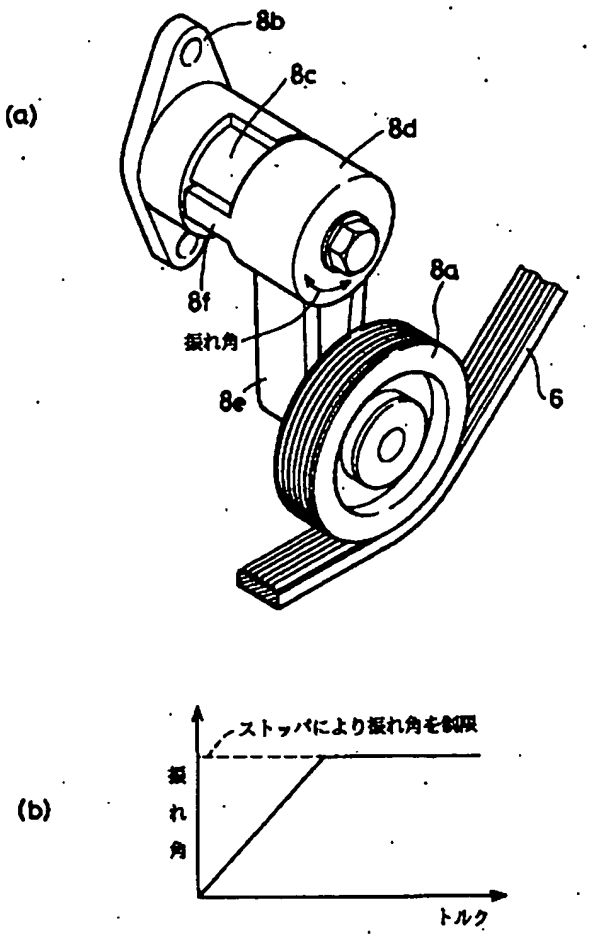


Figure 2

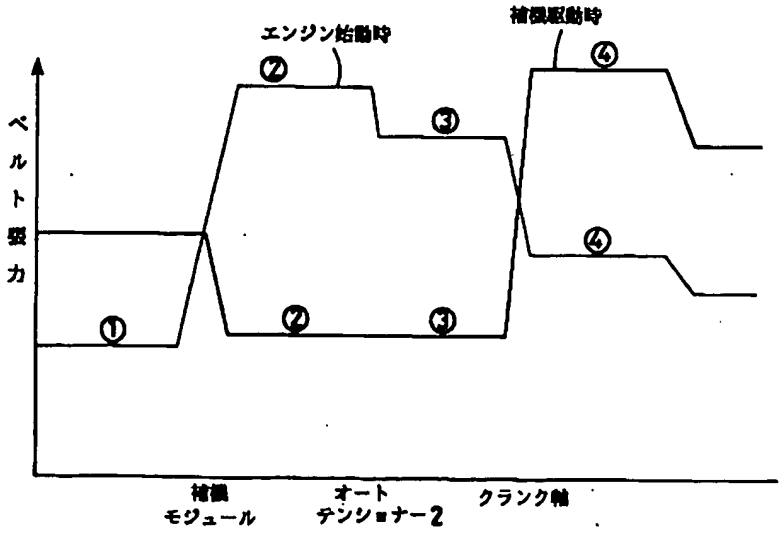


Figure 3

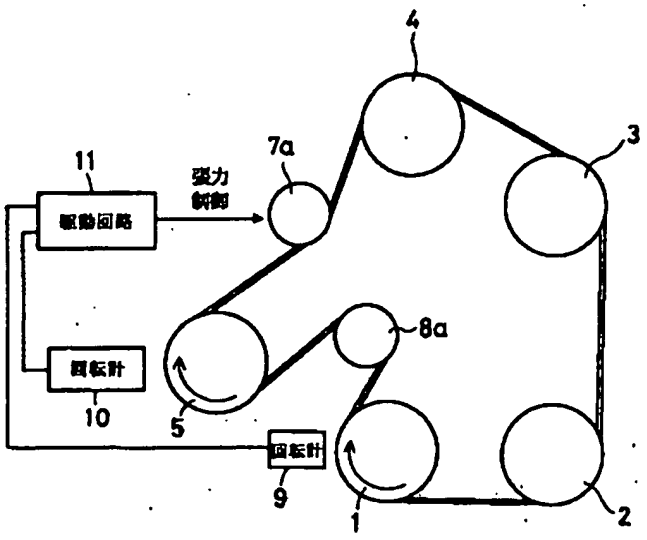


Figure 4

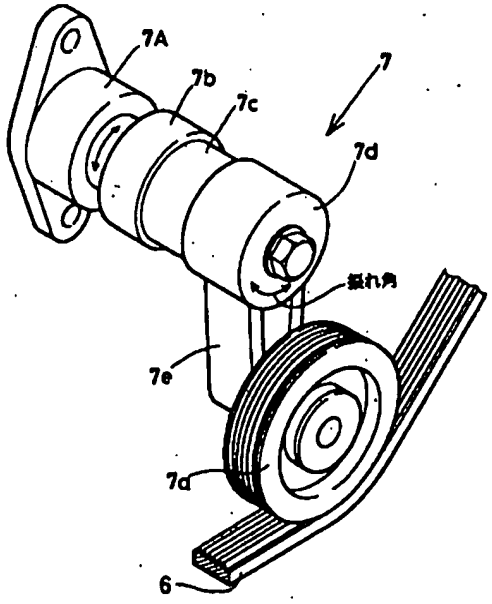


Figure 5

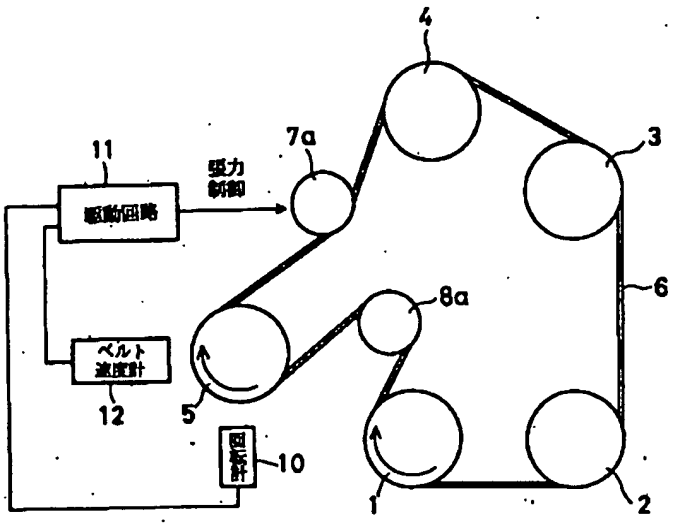


Figure 6

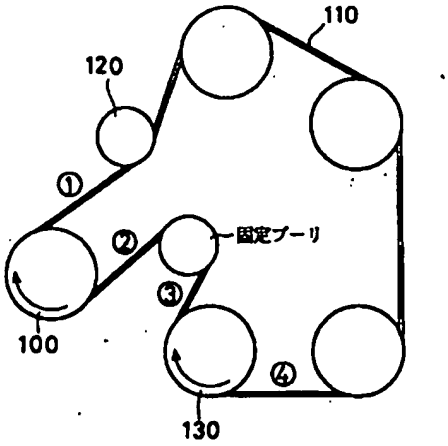


Figure 7

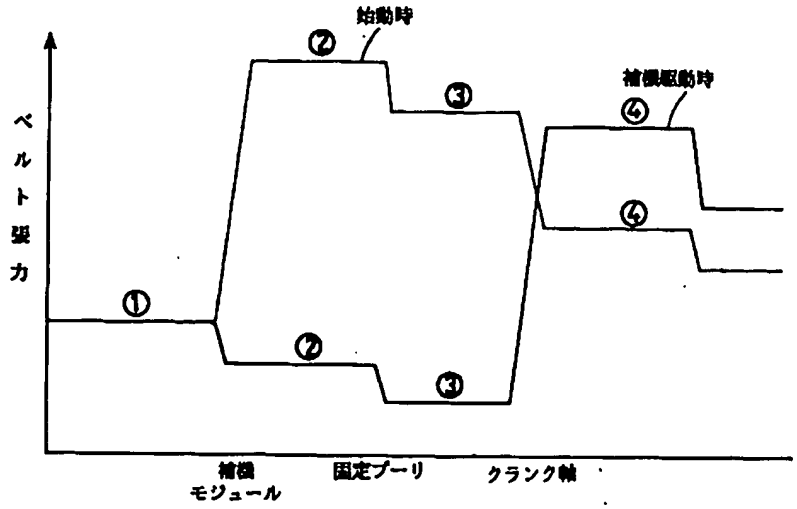


Figure 8.